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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/672,103	09/26/2003	Christy Mei-Chu Woo	H0024.D1	7107

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THE LAW OFFICES OF MIKIO ISHIMARU  
1110 SUNNYVALE-SARATOGA ROAD  
SUITE A1  
SUNNYVALE, CA 94087

EXAMINER
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ANDUJAR, LEONARDO

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 02/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 10/672,103	<b>Applicant(s)</b> WOO ET AL.	
	<b>Examiner</b> Leonardo Andújar	<b>Art Unit</b> 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 26 September 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 7-20 is/are pending in the application.
- 4a) Of the above claim(s) 7, 10-14 and 17-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☐ Claim(s) \_\_\_\_\_ is/are rejected.
- 7) ☒ Claim(s) 8, 9, 15 and 16 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09/26/2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Acknowledgment*

1. The pre amendment filed on 09/26/2003 has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 7-20.

### *Drawings*

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the first conformal barrier layer having *only vertical portions* according to claim 14, a treated area *on the first channel stop layer* according to claim 14; a first conductor core *over the first channel stop layer*; and the first conformal barrier layer having *only vertical portions* of a constant thickness according to amended claim 7, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered. As shown in figure 2, the first conformal barrier liner 126 does not have only vertical portion and does not have a constant thickness. The treated area 128 is not formed on the first channel stop layer 114. In other words, the drawings do not show that the first channel stop layer 114 having a treated area. The first conformal barrier liner of claims 7/14 correspond to the conformal barrier layer 126 described in the specification and shown in the drawings since this is the liner formed on the first dielectric layer/first channel dielectric layer 108. Also, the layer 112 correspond to the claimed via dielectric layer of claims 8/15); the layer 110 correspond to the second dielectric layer/second channel dielectric layer of claims 8/15. (see pg. 6/lis. 17-32; pg. 7/lis. 1-29). In the event that applicant read the

first dielectric layer/first channel dielectric layer as to correspond to the layer 112 (described in the specification as to be via dielectric layer) and the first conformal barrier liner correspond to the 146, it is respectfully noted that the via stop layer and the via dielectric layer according to claim 8 and 15 are not shown. Note the layer 110 is the second dielectric layer and cannot be recognized as the via dielectric layer. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement-drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

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art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 7 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The specification as originally filed does not disclose or describe that the "*first conformal barrier*" liner has only vertical portions "*of a constant thickness*" on the sidewalls of the opening. As shown in figure 2, the first conformal barrier liner 126 does not have a constant thickness at the vertical portions. It seems to have a different thickness at the bottom corner. According to the specification the first conformal barrier is the barrier layer formed on the first dielectric layer, which is the first channel dielectric layer (see pg. 6/lls. 17-32; pg. 7/lls. 1-29). The layers 146 cannot be recognized as to be the first conformal barrier layer since it is formed in the via dielectric layer and not in the first dielectric layer as specified in claim 7 and 14.

6. Claim 13, 18, 19 and 20 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

7. Claim 13 recites the limitation "the via dielectric layer, the second dielectric layer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

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8. Claim 18 recites the limitation "the second conformal barrier liner" in line 2.

There is insufficient antecedent basis for this limitation in the claim.

9. Claim 19 recites the limitation "the second channel dielectric layer" in line 2.

There is insufficient antecedent basis for this limitation in the claim.

10. Claim 20 recites the limitation "the second conductor core" in line 2. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 103***

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

12. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

13. Claims 7, 10-14 and 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pramanick et al. (US 6,239,021) in view of Harper et al. (US 6,300,236).

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14. Regarding claims 7 and 14, Pramanick (e.g. fig. 2 & claim 1) shows an integrated circuit comprising: a substrate 108 having a semiconductor device (e.g. fig. 1; col. 1/lls. 17-23 & col. 3/lls. 33-58); a device dielectric layer 110 over the substrate; a first channel stop layer 114 over the substrate and the device dielectric layer having a portion open to the semiconductor device; a first channel dielectric layer 116 over the first channel stop layer having a first channel opening provided therein having sidewalls in the first channel dielectric layer; a first conformal barrier liner 123 in the opening, acting as barrier to diffusion of conductor core material to the first channel dielectric layer; a treated area 124 on the first conformal barrier liner and the first channel stop layer to increase adhesion properties thereof; and a first conductor core 120 in the opening over the vertical portions of the first conformal barrier liner and the first channel stop layer, the first conductor core connected to the semiconductor device. Pramanick does not teach that the first conformal barrier liner has only vertical portions on the sidewalls of the first opening in the first channel dielectric layer. However, Harper (e.g. fig. 2b) teaches a first conformal barrier liner 15 having only vertical portions on the sidewalls of a first opening 14 in a first channel dielectric layer 11b. According to Harper, this type of embodiment improves the device electromigration lifetime (col. 1/lls. 19-67; col. 2/lls. 1-62). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the first conformal barrier liner having only vertical portions on the sidewalls of a first opening in the first channel dielectric layer disclosed by Pramanick in accordance with Harper's invention in order to improve the electromigration life of the device.

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15. Regarding claims 10 and 17, Harper teaches that the first conformal barrier liner may be a silicon-enriched material (col. 4/lis. 25-30).

16. Regarding claims 11 and 18, Harper teaches that the first conformal barrier liner may be a non-conductive barrier material and having a thickness between 20 and 200 angstroms (i.e. nitride; col. 4/lis. 25-30).

17. Regarding claims 12 and 20 (as understood), Pramanick shows that the first core and a second core 101 may comprise copper, silver, gold, aluminum, etc. (col. 4/lis. 20-22 & clm. 5).

18. Regarding claim 13, Pramanick teaches that the first dielectric layer 116, a via dielectric layer 108 and a second dielectric layer 105 are made of a low dielectric materials constant (col. 3/lis. 63-67). Also, Harper teaches that the first dielectric layer 11b, a via dielectric layer 11a and a second dielectric layer 11c are made of a low dielectric materials constant (col. 3/lis. 11-18).

19. Regarding claim 19, Harper teaches that the first dielectric layer 11b, a via dielectric layer 108 and a second dielectric layer 11c are made of a porous low dielectric such as polyimide having constant material having low dielectric constants under 3.9 (inherent property of polyimide; col. 3/lis. 11-18).

***Allowable Subject Matter***

20. Claims 8 and 9 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 1<sup>st</sup> paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.



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21. Claims 15 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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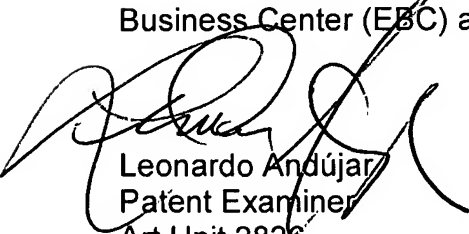
**Conclusion**

22. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Bao, Li, Lee and Nguyen teach structures and procedures similar to the instant invention.

23. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leonardo Andújar whose telephone number is 571-272-1912. The examiner can normally be reached on Mon through Thu from 9:00 AM to 7:30 PM EST.

24. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

25. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Leonardo Andújar  
Patent Examiner  
Art Unit 2826  
02/18/2005